International Journal of Economic Research

ISSN : 0972-9380

available at http: www.serialsjournals.com

Volume 14 • Number 20 • 2017

Importance of Joint Orientations in 3D Animation Rigging

Deepak Kochhar[1] and Pavitar Parkash Singh[2]

[1]*Assistant Professor and Research Scholar, Lovely Professional University, Punjab. Email: kochharonline@gmail.com*

[2]*Professor and Associate Dean, School of Arts & Languages, Lovely Professional University, Punjab*

ABSTRACT

The procedure of binding a 3D mesh with some controllers to make it convenient to animate for an animator is called character rigging. The rig normally consists of some joints, controllers or special GUI having some set of attributes. In modern day animation so many advancements have been done. The era of classical animated movies is being seen but have been replaced by 3D animation mostly. Though Traditional or classical animation have their own importance too. In production process of a 3D animated movie there are mainly three stages - Pre-Production, Production and Post-Production. While making character in 3D, the process is further divided into different stages i.e. Modelling, Texturing and Rigging. During animating a character, a common problem is faced by animators i.e. wrong orientation of joints. Due to which it is difficult to achieve desired pose or movement.

While rigging a 3D character it is very essential to maintain orientation of each joint for the smoother functioning of the rig. This paper attempts to make aware the 3d rigging artists about importance of correct joint orientation in rigging to achieve smoother animations.

Keywords: 3D Rigging, Character Rigging, Joints, Animation, Procedural Rigging, Joint Orientations.

1. INTRODUCTION

The process of animating a 3D character is very lengthy, time consuming and tiresome work. Because for animating a character one should know the process of joints linking, joint hierarchy, rigging controls etc. When character modelling is finished that is the first stage of building a character. At that point of time a character is nothing but a digital clay sculpture. It is next to impossible to animate the character without a bone or skeleton setup. The process of setting up bone structure and adding controllers for smooth functioning or movement of the character is called Rigging. Like a real skeleton has bones and joints, we

have to make such structure in a character. A rig can either be made in very simple manner or can be made with complexity, depending upon the movements required in the animation. Since 3D Modeling has become very easy than before. (Igarashi et. al., 1999)

Rigging is an essential part of 3D animation in which a set of controllers are linked to each joint of the character's body. These controllers are mainly made up of curves, locators or handles or in some cases a separate GUI (Graphical user interface) is created to control the rig mostly in facial controls. When setting up of bones and controllers is finished then these joints are linked with body mesh and this process is known as binding. Every time the rigging is done as per the requirement of the motions involved during its animation. Placement of the controllers accurately with joints wherever required helps an animator to give it a real life motion. Many times it is seen that rigs are faulty because of minute mistakes made by a rigger which creates difficulties for an animator to give it a motion. Joint orientation is one of such mistake which can create huge problems for an animator. To understand Joint orientation one must first understand the basics of rigging such as: Hierarchy, Forward Kinematics, Reverse Kinematics.

1.1. Hierarchy

While rigging a character it is very important to follow a logical hierarchy. All the joint should be linked together with parent-child relationship method. Every Prior bone in the hierarchy is the parent to its next bones. There is always a master or root joint which is at the pelvis to control the whole rig all together.

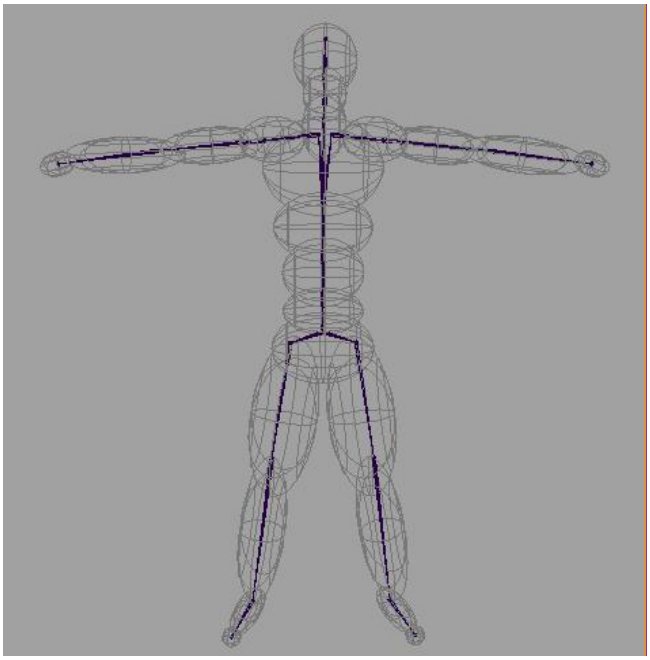

Figure 1: Joint based rig in a hierarchy for Biped Character

1.2. Forward Kinematics

Forward Kinematics is a method which is used for smooth movement and rotation of the joints. Usually FK setup is used for spine and arms. In forward kinematics, any joint can affect the other joints of the hierarchy that fall below it.

For Example: If there is FK setup in an arm then, by moving or rotating the shoulder joint, its children i.e. bicep, elbow, forearm, wrist and hand will follow the shoulder. The final movement of every child joint is based upon the movement of its parent joint.

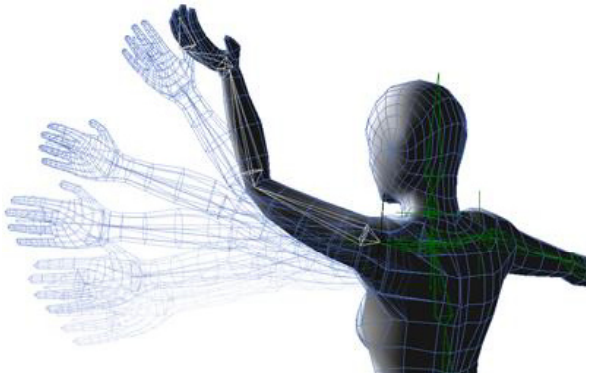

Figure 2: Arm FK setup

1.3. Reverse Kinematics

Inverse Kinematics is the opposite method from forward kinematics, and is used for rigging a character's arms and legs. With an IK rig, the ending joint is placed by the rigger, while the movement of overhead joints on the hierarchy are automatically calculated by the software.

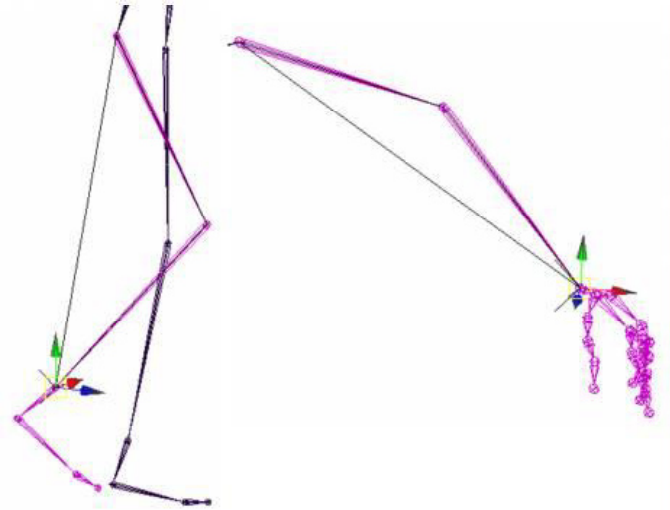

Figure 3: IK setup for an arm and leg

2. METHODOLOGY

Joint orient is "How the Joints are aiming"? It is very important to distinguish about Joint orientation while rigging. Many riggers make this mistake of not paying attention towards the joint orientation while rigging. So when an animator works on these faulty rigs, these orientations create huge problems. Basically joint will rotate at a different angle than an animator wants it to rotate. This problem is also referred as silent or hidden destroyer in animation studios. Joints in any animation software will visually appeal like they are all right but in terms of movement or rotation they are faulty.

Now the question arise is "Are defaults important"? Because at the time of setting up a bone hierarchy some riggers never pay attention towards the joint orientation. It is assumed that they are perfect by default but at the time of movement and rotation they act differently. So it is essential to check the joint orientations before sending it out for animation. To understand more about joint orientation, it is important to study about axis in a 3D animation software.

2.1. Object

Transforms the object in its own space system. The axis direction is based on the rotations of the object. If more than one object is selected, then both objects will transform on their own object space coordinate system.

2.2. Local

The object is related to the parent object and will rotate as per the rotation of the parent object. If more than one object is selected, then both objects will transform on their own object space coordinate system.

2.3. World

It transforms the object in the world space coordinate. The object will be aligned with the world space axis which is the default position. So it is clear that when a rigger creates a joint based hierarchy, by default it is created according to the world axis. But should be aligned according to the Local axis. In the following picture the joint Orientation shown are those which were created by default. It can be seen for some bones Z axis is on the other side and in others Z axis is on opposite side. So when an animator will try to rotate whole hierarchy all together, it will react indifferently.

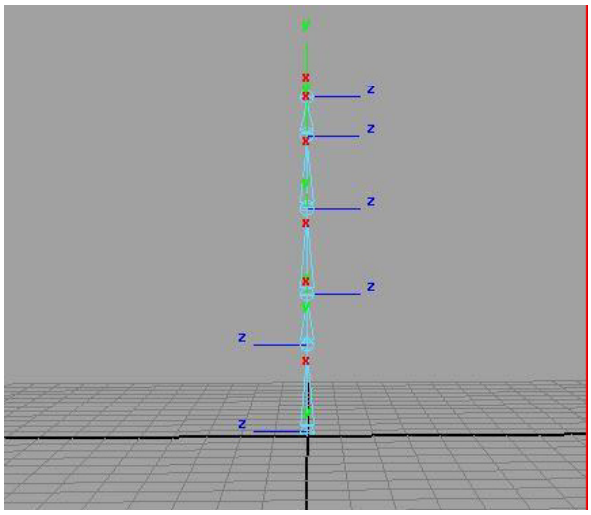

Figure 4: Joint orientations by default

3. RESULTS AND DISCUSSION

Joint orientation matters a lot when it comes to rigging because when an animator gives motion to a model he actually moves the joint inside the mesh with help of the controllers outside. If the joints are not oriented in proper manner the it will be difficult to handle the rig and even more difficult to change one pose from

another. The animator will encounter a weird and an awkward situation. That is why it is essential to check the joint orientations while finalizing the rigs and sending it for animation.

Now, in the picture below the joint orientations are corrected by using Freeze transformation in Maya. It can be seen after doing this all the orientations are same. But sometimes even doing freeze transformation is not enough, in that case rigger should rotate the joint orientation manually to resolve the problem.

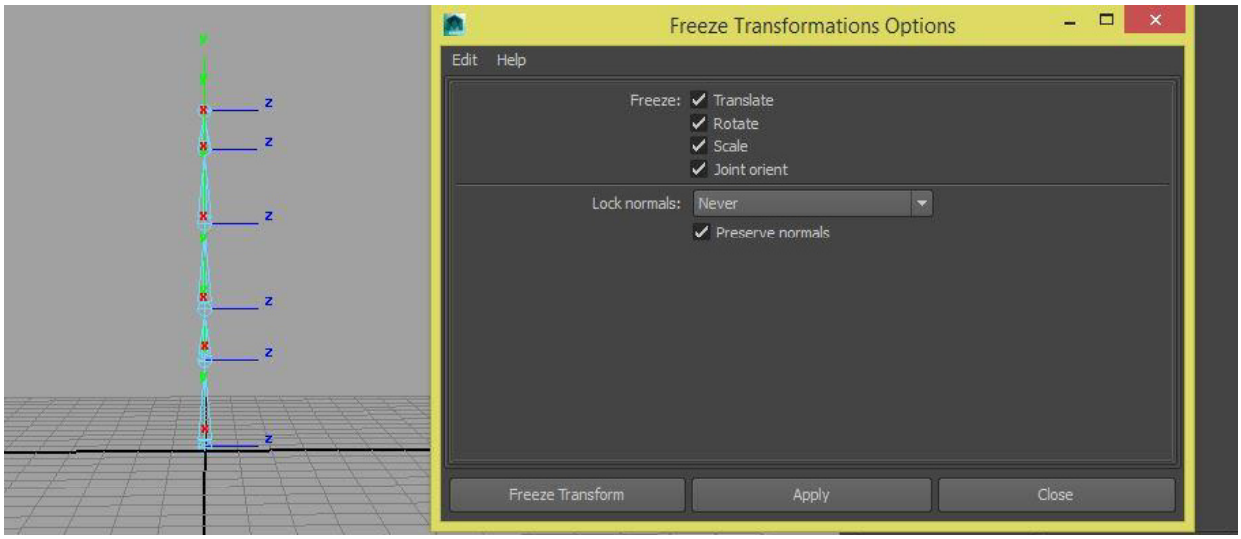

Figure 5: Correct Joint orientations

3.1. Extra Controls for Joints in Maya

Maya Joints have some extra transform controls as compared to other Maya objects. One can find these attributes in attribute editor for joints after selecting a particular joint in viewport.

Joint Orient - It rotates the joint but leaves the "rotation channel Attributes" at 0, 0, 0.

Rotation order - It is on all Maya objects but acts differently on joints due to joint orientation.

Rotation Axis - This visual axis shows how the joint is aimed because of the joint orientation.

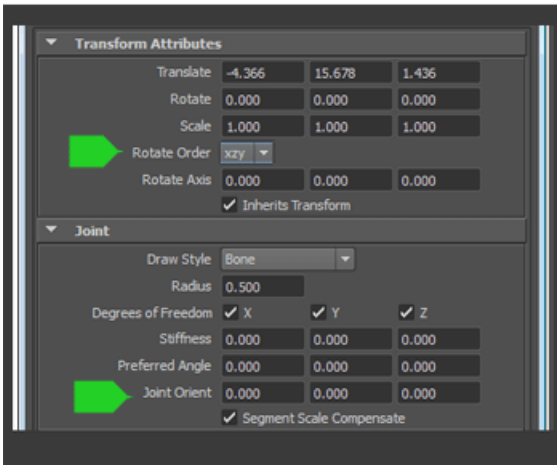

Figure 6: Transform attributes for Joints

References

E. Allen and K. Murdock, Body Language: Advance 3D Character Rigging, First Edit. Cybex. Wiley Publishing, INC, 2008.

Igarashi, T., Matsuoka, S., and Tanaka, H. (1999). Teddy: A sketching interface for 3d freeform design. In Proceedings of ACM SIGGRAPH 1999, Annual Conference Series, 409–416.

Igarashi, T., Moscovich, T., and Hughes, J.F. (2005). Spatial keyframing for performance-driven animation. In Symposium on Computer Animation (SCA), 107–115.

Nelder, J., and Mead, R. (1965). A simplex method for function minimization. Computer Journal 7, 308–313.

S. Katz and A. Tal, "Hierarchical mesh decomposition using fuzzy clustering and cuts," ACM Trans. Graph., Vol. 22, No. 3, p. 954, Jul. 2003.

Teichmann, M., and Teller, S. (1998). Assisted articulation of closed polygonal models. In Computer Animation and Simulation '98, 87–102..